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BULLETIN
OF THE
TORREY BOTANICAL CLUB

APRIL, 1908

Hepaticae of Puerto Rico

IX. BRACHIOLEJEUNEA, PTYCHOCOLEUS, ARCHILEJEUNEA, LEUCOLE-
JEUNEA, AND ANOPOLEJEUNEA

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(WITH PLATES 6-8)

BRACHIOLEJEUNEA

The genus *Brachiolejeunea* includes between twenty and thirty recognized species. About half of these are American, the others being found in eastern Asia or among the islands of the Pacific. No species has as yet been reported from Africa. Although essentially tropical in its distribution, the genus reaches its northern limits in Florida and Japan and its southern in Australia and Patagonia. Since the first species described by Spruce is *B. laxifolia* (Tayl.) Schiffn., this may be considered the type of the genus. It was originally described from specimens collected by Jameson in Ecuador but is now known also from Bolivia.

With scarcely an exception the species of *Brachiolejeunea* are found on trees or on rotten logs. In many cases they grow mixed with other *Lejeuneae* or with *Frullaniae* but they sometimes form extensive mats by themselves. The plants are usually more or less pigmented and often appear very dark brown or nearly black, with little or no indication of glossiness. The prostrate stems cling closely to the substratum by means of numerous rhizoids, which take their origin from rudimentary discs at the bases of the underleaves. The branching is at first irregularly pinnate, but the female plants after flowering usually exhibit a false dichotomy very much as in *Marchesinia*.

The leaves are imbricated and sometimes densely so. In dry

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plants the lobes are suberect and wrapped around the stem, but as soon as they become moistened they spread widely (PLATE 6, FIGURE 1) and assume a more or less squarrose position. The change in appearance is very similar to what is found in the genus *Mastigolejeunea*. The lobes are approximately ovate in outline and vary at the apex from rounded to apiculate or acute. The margin is usually entire, but, in certain species, tends to be slightly serrulate in the neighborhood of a female inflorescence. The lobule is relatively large and consists of two distinct portions approximately equal in size (FIGURES 1, 2). One of these occupies the carinal region and takes part in the formation of a conspicuous water-sac, usually about half as long as the lobe. The other is bounded by the free margin and is closely appressed to the lobe except at the apical sinus where an opening into the sac is to be observed. The appressed portion of the free margin bears a series of teeth from three to ten in number. These teeth vary greatly in size and in form (FIGURES 7-9), but in the majority of cases each tooth is several cells long and so strongly curved toward the lobe that it cannot be straightened out even by pressure on the cover-glass (FIGURE 12). The outermost tooth, which represents the apex of the lobule, varies from a single projecting cell to a broad and rounded projection (FIGURES 10, 11). The hyaline papilla is borne at the proximal base of this tooth but is displaced to the inner surface of the lobule, usually appearing two or three cells from the margin. Beyond the apical tooth the long and shallow sinus extends, forming a very acute angle with the outer part of the keel. The latter is more or less arched near the base but tends to be incurved where it meets the postical margin of the lobe. The leaf-cells have thin walls but distinct trigones (FIGURE 6). These are usually triangular in outline, two of the sides being convex and one concave. The thin places between the trigones are relatively wide and rarely develop intermediate thickenings.

The undivided underleaves are rotund to reniform in outline and are attached by an arched line (FIGURE 1). In certain species they are distinctly auriculate at the base (FIGURE 14); in others they are rounded or even cuneate. The margins are sometimes plane and sometimes more or less revolute; they vary from entire to irregularly sinuate but are never distinctly toothed.

In the majority of the species two types of branching are to be observed, very much as in the genus *Bryopteris* and in certain other genera of the *Lejeuneae Holostipae*.^{*} In at least one species, however, all of the branches seem to conform to the *Lejeunea* type, being borne behind leaves with lobules. The *Frullania* type of branching, in which the subtending leaves fail to develop lobules, is largely restricted to robust vegetative axes. In a branch of this character the subtending leaf is partly inserted on the main axis and partly on the branch, the postical base being slightly revolute (FIGURES 2, 13). The first underleaf is usually distinctly bilobed and is displaced in such a way that the branch seems to arise from its axil. It embraces the base of the branch and partially enwraps the postical base of the subtending leaf. The first leaf is of small size and complicate-bilobed, but the lobule is explanate and rounded at the apex. The succeeding leaves and underleaves are normal in appearance. The *Lejeunea* type of branching, even where it does not occur in the vegetative portion of a plant, is almost invariably associated with subfloral innovations. An exception to this condition, however, is found in the remarkable *B. sandwicensis* (Gottsche) Evans, of eastern Asia and the Hawaiian Islands.[†] In this species the bract behind which a subfloral innovation arises is wholly destitute of a lobule and is partially inserted on the innovation itself.

The inflorescence in *Brachiolejeunea* seems to be fairly constant for a given species and may be dioicous, autoicous, or paroicous. The female branch varies greatly in length but is usually distinctly elongated. Subfloral innovations are invariably present and usually occur in pairs (FIGURES 4, 5); in rarer cases only one innovation is developed. The innovations are often floriferous and give rise to the false dichotomy which is characteristic of the genus. The bracts are scarcely complicate and the lobe is usually more pointed than in the leaves. In many species a wing is developed at the base of the keel (FIGURES 4, 5). The bracteole is free or nearly so and varies at the apex from rounded to retuse or shortly bilobed. The perianth scarcely projects beyond the bracts unless the basal portion elongates with the development of the sporophyte. It is

^{*} See Evans, Bull. Torrey Club 34 : 559. 1908.

[†] Trans. Conn. Acad. 10 : 419. 1900.

approximately obovoid in shape and rounded to truncate at the apex, with a short beak. It is sometimes terete and sometimes more or less compressed, but even in the latter case the lateral keels are never sharp. The postical surface bears from two to five keels, and the antical surface is either plane or provided with three or four keels (FIGURES 21, 22). All of the keels are rounded and are never winged or toothed in any way. In pluriplicate perianths they are separated from one another by deep grooves, and there is no difference, except in position, between the lateral keels and the others.

In autoicous and dioicous species the male spikes are long and often proliferate at the apex. The bracts are imbricated and tend to be smaller than ordinary leaves, but their lobules are relatively larger and more strongly inflated. Even here the free margin of the lobule is usually more or less toothed. The antheridia occur in pairs, and the bracteoles are found throughout the entire length of the spike. In paroicous species the bracts are much fewer and are essentially like normal leaves; they differ also from the bracts just described in bearing the antheridia singly.

The present genus is in most respects clearly defined. The squarrose leaves, the large lobules with teeth along the free margin, the subfloral innovations usually occurring in pairs, and the plicate perianth with unarmed keels afford an excellent combination of generic characters. Certain species, however, as Spruce has already pointed out, show a relationship with *Marchesinia*, while others are even more closely allied to the genus *Ptychocoleus* as restricted in the present paper. In most species of *Marchesinia* the free margin of the lobule is also denticulate and the subfloral innovations occur in pairs, but the leaves are not squarrose and their lobes are relatively smaller and very different in appearance from those found in *Brachiolejeunea*. The perianth, moreover, is distinctly compressed and plane on both antical and postical surfaces. The characters which separate *Brachiolejeunea* from *Ptychocoleus* will be considered under the latter genus.

Two species of *Brachiolejeunea*, ***B. densifolia*** (Raddi) comb. nov.* and *B. corticalis* (Lehm. & Lindenb.) Schiffrn., have been re-

* This species is commonly known as *B. bicolor* (Nees) Schiffrn., in spite of the fact that *Frullanoides densifolia* Raddi and *Jungermannia bicolor* Nees have long been considered synonyms. Trevisan restored Raddi's specific name, but has not been fol-

ported from the West Indies. Neither of these has yet been found in Puerto Rico, but a third species occurs in recent collections from the island. It is apparently undescribed and may be characterized as follows:

***Brachiolejeunea insularis* sp. nov.**

Dull-yellowish or brownish-green, sometimes almost black, scattered or growing in depressed mats: stems 0.25 mm. in diameter, sparingly pinnate, the branches obliquely to widely spreading, similar to the stem but with somewhat smaller leaves, never microphyllous: leaves closely imbricated, the lobes slightly falcate, ovate, 1.2–1.7 mm. long, 0.85–1.2 mm. wide, rounded to subcordate at the base and rounded or very obtuse at the apex, margin entire, strongly outwardly curved from the antical base to the apex; lobule ovate-triangular in outline, 0.85–1 mm. long, 0.35–0.45 mm. wide, the inflated portion forming a conical water-sac about half as long as the lobe, keel nearly straight from a more or less arched base, usually forming a continuous line with the postical margin of lobe, free margin rounded to cordate at the base, usually bearing from eight to ten more or less distinct teeth, those normally developed two or three cells long, one or two cells wide at the base and curved inward toward the lobe, apical tooth very variable; cells of lobe more or less convex, averaging $14\ \mu$ at the margin, $28 \times 22\ \mu$ in the middle and $35 \times 28\ \mu$ at the base, intermediate thickenings infrequent, oval: underleaves loosely imbricated, plane, broadly orbicular, 0.6–0.7 mm. long, 0.75–0.85 mm. wide, distinctly auriculate at the base with crenulate auricles, margin otherwise entire or irregularly sinuate, apex broad, truncate to retuse: inflorescence parocious: ♀ inflorescence borne on a long branch and innovating on both sides; bracts erect-spreading, indistinctly complicate and unequally bifid, the lobe ovate to oblong, 1.4 mm. long, 0.85 mm. wide, rounded to obtusely pointed at the apex, margin more or less sinuate and crispate but not toothed, lobule adnate to lobe for greater part of its length, ovate to oblong, 0.85 mm. long, 0.35 mm. wide, apex mostly acute, rarely blunt, margin mostly entire but rarely with a tooth near the apex, wing broad, approximately semi-circular, entire, usually adnate for its whole length; bracteole

lowed by subsequent authors. The synonymy of the species is as follows: *Frullanoides densifolia* Raddi, Mem. Soc. Ital. Modena Fis. 19: 38. 1823; 20: pl. 2. f. 5. 1829. *Jungermannia bicolor* Nees, in Martius, Fl. Bras. 1¹: 349. 1833. *Lejeunea bicolor* Nees, in Montagne, Flor. Boliv. 66; d'Orbigny, Voy. dans l'Amér. Merid. 7². 1839. *Phragmicoma bicolor* Nees, in G. L. & N. Syn. Hep. 294. 1845. *Ptychocoleus densifolius* Trevis. Mem. Ist. Lomb. III. 4: 405. 1877. *Lejeunea* (*Brachiolejeunea*) *bicolor* Spruce, Hep. Amaz. et. And. 131. 1884. *Brachiolejeunea bicolor* Schiffn. in Engler & Prantl, Nat. Pflanzenfam. 1³: 128. 1895.

oblong to obovate, 1.2 mm. long, 0.85 mm. wide, plane or nearly so, margin entire or irregularly sinuate, apex broad, truncate or subretuse; perianth slightly exserted beyond the bracts, oblong-obovoid, 1.5 mm. long, 0.85 mm. wide, rounded to truncate at the apex, slightly or not at all compressed, mostly ten-keeled, the keels extending to below the middle, rounded and separated by deep grooves: ♂ bracts in one or two pairs below the involucre, essentially like the ordinary leaves: mature sporophyte not seen. (PLATE 6.)

On trees and logs. Near Mayagüez, *Heller* (4463a). Near Cayey, *Evans* (97). Mount Morales, Utuado, *Howe* (465). The writer's specimens from near Cayey may be designated the type. The species has also been collected in Cuba, *Wright*, *Underwood* & *Earle*, and in Jamaica, *Underwood*, *Evans*.

B. insularis is closely related to *B. densifolia*, and the two species have been more or less confused. *B. densifolia* was originally collected in Brazil, where it seems to be abundant and widely distributed. Its range extends also along the chain of the Andes from Colombia to Bolivia. In North America it has been recorded from Mexico by *Gottsche* and from the island of St. Vincent by *Spruce*. It resembles *B. insularis* in general habit, in its auriculate underleaves and in its pluriplicate perianth. It is markedly distinct, however, in its dioicous inflorescence, the male inflorescences forming long spikes with closely crowded bracts. It differs also in its greater size, in its more sharply pointed leaves, in the fewer and smaller teeth along the free margin of the lobule and in its revolute underleaves. Even in *B. densifolia* the leaves are sometimes rounded as in *B. insularis*, but this is an exceptional condition and is usually associated with incomplete development.

B. corticalis, which is surely to be expected in Puerto Rico, is considerably smaller than *B. insularis*, and the teeth along the free margins of the lobules are fewer and simpler, each tooth consisting usually of a single projecting cell. The species is further characterized by its dioicous inflorescence, by the more distinct bracteal lobules, ligulate-lanceolate in outline and rounded at the apex, and by the more strongly compressed perianth with fewer and more irregular keels. Another close ally is *B. chinantlana* (*Gottsche*) *Schiffn.*,* at present known from Mexico and Ecuador.

* *Hedwigia* 33: 180. pl. 9. f. 32-40. 1894. The species is based on *Phragmcoma bicolor* var. *chinantlana* *Gottsche*, Mex. *Leverm.* 172. 1863.

This species agrees with *B. insularis* in its inflorescence, but the lobes of its leaves and bracts are sharply pointed. The bracteole is also said to be emarginate or even bifid, but the figure of Schiffner does not show this condition clearly.

PTYCHOCOLEUS

The history of Trevisan's genus *Ptychocoleus* has already been noted by the writer in another connection.* It is based on *Phragmicoma*, § *Ptychanthoides* of the Synopsis Hepaticarum, and most of its species would be included in the genera *Acrolejeunea*, *Brachiolejeunea* or *Mastigolejeunea*, as these are at present understood. The first species listed by Trevisan is *P. aulacophorus* (Mont.) Trevis. This was originally described by Montagne,† under the name *Phragmicoma aulacophora*, from specimens collected in the Mangareva or Gambier Islands, of Spencer Gulf, South Australia, but is now known to have a wide range extending into both Asia and Africa. *Ptychocoleus aulacophorus* would naturally be selected as the type of the genus. This species, however, is placed by Stephani in *Acrolejeunea*, and it therefore seems justifiable, in restoring the name *Ptychocoleus*, to apply it to the genus *Acrolejeunea* as defined by Spruce and by Schiffner.

In this restricted sense *Ptychocoleus* would include between forty and fifty recognized species, all of which are tropical in their distribution. It attains its best development in southeastern Asia and the islands of the Pacific but is also well represented in Africa. In America five species are at present known, three of which have been reported from the West Indies. Only one species, however, *P. polycarpus* (Nees) Trevis., has been collected in Puerto Rico. As in the preceding genus, practically all the species of *Ptychocoleus* grow on trees or on rotten logs.

The genus is characterized by an elongated female branch without innovations and by a plicate perianth with smooth keels (PLATE 7, FIGURE 2), the number varying from four to ten in different species. The absence of subfloral innovations will at once distinguish it from *Brachiolejeunea*, but the two genera agree so

* Bull. Torrey Club 34 : 543. 1908.

† Ann. Sci. Nat. Bot. II. 19 : 259. 1843. Voy. au Pôle Sud, Bot. 1 : 210. pl. 19. f. 1. 1845.

closely in the characters derived from the lobes of the leaves, from the underleaves, and from the bracts and perianths that it would be superfluous to describe these organs in detail for *Ptychocoleus*. There are also no essential differences in color, in general habit, or in cell-structure. The lobules of the leaves, however, are much more variable in *Ptychocoleus* than in *Brachiolejeunea*, especially with respect to the number of teeth on the free margin. Certain species develop as many as four or five teeth, others only two (FIGURE 5), while in still others the margin is quite entire except for the apical tooth. In the position of the hyaline papilla the genus agrees with *Brachiolejeunea*, except for the fact that it is sometimes so much displaced that it is difficult to determine whether it is distal or proximal to the apical tooth, while on the other hand it may arise directly from a marginal cell. The position, however, is usually constant for a given species. The branching, so far as observed, always conforms to the *Lejeunea* type.

The genus shows but little relationship with other *Lejeuneae* which lack subfloral innovations. In *Lopholejeunea* the keels of the perianth are winged and variously toothed or lacinate, the lobules are built up on a different plan, and the local thickenings in the cell-walls are different. In *Caudalejeunea* the perianth is trigonous, its keels are normally winged and toothed, the plants are different in habit, and the leaf-cells show very numerous intermediate thickenings. In *Bryopteris* the female branch is much shorter, the perianth is again trigonous, the leaves and underleaves are sharply toothed, and the whole habit, general appearance, and cell-structure are different.

PTYCHOCOLEUS POLYCARPUS (Nees) Trevis.

Jungermannia polycarpa Nees, in Martius, Fl. Bras. 1¹: 350. 1833.

Phragmicoma polycarpa Nees, in G. L. & N. Syn. Hep. 295. 1845.

Lejeunea domingensis Tayl. Lond. Jour. Bot. 5: 389. 1846.

Ptychocoleus polycarpus Trevis. Mem. Ist. Lomb. III. 4: 405. 1877.

Lejeunea (*Acro-Lejeunea*) *domingensis* and *polycarpa* Spruce, Hep. Amaz. et And. 116. 1884.

Acrolejeunea polycarpa Schiffn. in Engler & Prantl, Nat. Pflanzenfam. 1³: 128. 1895.

Olive-green, not glossy, scattered or growing in depressed mats: stems 0.17 mm. in diameter, irregularly pinnate, the branches widely spreading, occasionally microphyllous: leaves densely imbricated, the lobe suberect and convolute when dry, widely spreading and squarrose when moist, more or less convex, broadly ovate, slightly falcate, 1–1.2 mm. long, 0.85–0.95 mm. wide, arching partially or wholly across axis, rounded at base, rounded to very obtuse at the apex, margin entire, strongly outwardly curved from the antical base to the apex; lobule ovate, 0.6 mm. long, 0.35 mm. wide, the inflated portion occupying a little more than the carinal half, keel arched, forming an obtuse or rounded angle with the postical margin of lobe, free margin straight or a little curved, often bearing a tooth one or two cells long in the vicinity of the apical tooth, the latter mostly two cells long and one and two cells wide at the base, slightly outwardly curved, hyaline papilla borne on a marginal cell but slightly displaced to the inner surface of the lobule; cells of lobe plane or nearly so, averaging 15μ at the margin, $23 \times 18\mu$ in the middle and $35 \times 18\mu$ at the base, intermediate thickenings occasional, oval or circular: underleaves loosely imbricated, plane or slightly revolute at the apex, broadly orbicular-obovate, 0.6 mm. long, 0.75 mm. wide, cuneate toward base and attached by an arched line, broad and truncate at the apex, margin entire or vaguely angular-denticulate: inflorescence autoicous or polyoicous: ♀ inflorescence borne on an ascending and more or less elongated branch; bracts widely spreading, complicate with a rounded keel and shortly and unequally bifid, the lobe ovate, 1.6 mm long, 0.85 mm. wide, acute and apiculate, the apex usually tipped with a row of two or three cells, margin entire, lobule acuminate, otherwise similar to the lobe, 1.4 mm. long, 0.4 mm. wide; bracteole free, oblong or ovate, 1.4 mm. long, 0.85 mm. wide, undivided and acute or shortly bidentate at the apex with sharp or blunt teeth, margin otherwise entire; perianth about one third exserted, obovoid, 1.5 mm. long, 0.85 mm. wide, slightly compressed and cuneate toward the base, truncate to retuse at the apex, antical face plane or nearly so, postical face with two confluent rounded keels often extending beyond the beak: ♂ inflorescence terminating a more or less elongated simple branch, not proliferating; bracts mostly in eight to twelve pairs, shortly and unequally bifid with a strongly arched keel, lobe obliquely spreading, more or less squarrose, rounded, lobule suberect, mostly acute; antheridia borne singly; bracteoles extending the whole length of the spike, similar to the underleaves but more often revolute at the apex: capsule about 0.5 mm. in diameter, walls of inner layer of cells thickened on the inside with a few large circular or oval pits;

spores green, spherical or ellipsoidal, $35\ \mu$ in diameter, minutely verruculose and with circles of indistinct radiating ridges; elaters about $10\ \mu$ in diameter, sometimes bispiral in the middle. (PLATE 7, FIGURES I-II.)

On trees. Between Cayey and Caguas, *Howe* (1411 *p. p.*, 1414). Type locality, Brazil, *Martius*; since found by numerous collectors. Known also from Mexico, *Liebman*, and from the following islands of the West Indies: Cuba, *Wright*; Santo Domingo, *Persoon* (the type locality of *Lejeunea domingensis*); Jamaica, *Harris, Evans*.

The species is not well described in the Synopsis Hepaticarum, but some of its most significant characters have since been emphasized by Schiffner.* Considerable confusion was introduced by Taylor into the synonymy of the plant by the publication of *Lejeunea domingensis*. This species was based on specimens which he at first called *L. linguaeifolia*, and material thus named was deposited in the Hooker herbarium. Subsequently he renamed the species *L. domingensis* and transferred the name *L. linguaeifolia* to an entirely distinct plant collected by Richard on the island of St. Thomas. Both species were soon afterwards published in the same paper. Many years later, Spruce, basing his opinion on the specimens in the Hooker herbarium rather than on Taylor's descriptions, referred both *L. domingensis* and *L. linguaeifolia* to his subgenus *Acro-Lejeunea*, apparently considering them distinct from each other and also from *Ptychocoleus polycarpus*. Through the study of authentic material in the Lindenberg herbarium, Stephani† was able to reduce both species to synonymy, *L. domingensis* proving to be identical with *Ptychocoleus polycarpus* and the true *L. linguaeifolia* from St. Thomas proving to be the same as *Brachiolejeunea corticalis*. Specimens in the Mitten herbarium, now in the possession of the New York Botanical Garden, amply confirm the conclusions of Stephani.

The keels of the perianth in *P. polycarpus* scarcely extend below the middle and are exceedingly variable even on a single plant. According to Schiffner, five or six keels are present, while Spruce gives the number as four or five. These discrepancies are

*Hedwigia 33: 181. 1894. See also Gottsche, Abhandl. naturw. Verein. Bremen 7: 350, 351. 1882.

†Hedwigia 28: 166, 167. 1889; 29: 22. 1890.

doubtless due to differences of interpretation. When the antical surface is deeply grooved it produces the effect of two rounded keels, making the total number five or six, according to whether the confluent postical keels are counted as one or two. When the antical face is plane the number of keels would naturally be estimated as four.

The two other species of *Ptychocoleus* which have been reported from the West Indies are *P. torulosus* (Lehm. & Lindenb.) Trevis. and *Lejeunea* (*Acrolejeunea*) *atroviridis* Spruce,* both of which are listed by Spruce from the island of St. Vincent, where they were collected by Elliott. The second of these species is known from no other locality, but *P. torulosus* is known also from Guiana and Brazil. In *L. atroviridis* the trigones of the leaves are absent or minute and the keels of the perianth are more or less roughened, so that it is possible that it ought to be referred to some other genus. *P. torulosus*, however, is a typical representative of *Ptychocoleus*. It may be at once distinguished from *P. polycarpus* by the blunt lobes and lobules of its bracts, by its truncate bracteole and by its seven- to nine-keeled perianth. It is distinct also in the lobules of its leaves, which bear from three to eight teeth along the free margin instead of one or two.

ARCHILEJEUNEA

According to Schiffner, the genus *Archilejeunea* contained thirty species in 1895, and perhaps a dozen new species have been proposed since he made his estimate. If, however, *A. porelloides* (Spruce) Schiffn., the first species described by Spruce, be selected as the type of the genus, certain species have been referred to it which can hardly be considered congeneric with this type species. This is the case, for example, with *A. pseudocucullata* Steph. (*Lejeunea holostipa* Spruce), which the writer has already made the type of the genus *Cyrtolejeunea*.† It is true of *A. xanthocarpha* (Lehm. & Lindenb.) Steph. and its immediate allies, for the reception of which the genus *Leucolejeunea* Evans has recently been proposed. It is also true of *A. conferta* (Meissn.) Schiffn., which belongs to the genus *Anoplolejeunea* and is even synonymous with its type species.

* Jour. Linn. Soc. Bot. 30: 335. pl. 20. f. 5-10. 1894.

† Bull. Torrey Club 30: 552. 1903.

If these aberrant forms are removed, the species which are left will fully agree with the characters assigned to the genus by Spruce and by Schiffner. In the majority of cases the plants are robust and show a reddish or brownish pigmentation. A prostrate and irregularly branched caudex is first developed, which clings closely to the substratum (PLATE 8, FIGURE 2). From this, secondary stems soon arise which are more or less free from the substratum and rarely form rhizoids; they branch irregularly, many of the branches being subfloral innovations (FIGURE 1). Although the branches frequently bear smaller leaves than the stem, they are never truly microphyllous.

The leaves are imbricated but not densely so, and the lobes spread obliquely or widely from the axis, being more or less falcate. They vary in outline from suborbicular to ligulate, the apices are rounded and the margins are entire. The lobules, in their most typical form, are rhomboidal in outline, the keel being straight or nearly so. In some cases about half of the lobule is appressed to the lobe, restricting the water-sac to a narrow linear space along the keel. In other cases the appressed portion is much narrower (FIGURE 2) and may even be absent altogether, the free margin meeting the lobe at a right angle. Under these circumstances the water-sac is relatively larger and the entire lobule may enter into its formation. The free margin is more or less curved and terminates in an apical tooth, which varies from subacute to long-acuminate; the sinus beyond is long but usually shallow. The hyaline papilla is at the proximal base of the apical tooth and may be either marginal or slightly displaced to the inner surface of the lobule. Except for the apical tooth the margin is commonly entire. In certain species, however, a second tooth is sometimes developed, proximal in position to the papilla (FIGURE 4). In some cases the secondary stems fail to develop normal lobules (FIGURE 1), and it becomes necessary to search for them on the prostrate caudex. The cells of the lobe have firm and pigmented walls and are usually a little convex. The trigones are large and conspicuous, and intermediate thickenings are frequent. The trigones are sometimes triangular but it is more usual for them to be triradiate with rounded rays (FIGURE 3).

The underleaves vary from orbicular to reniform. They are

broad and rounded at the apex, entire along the margin, and variable at the base, being sometimes cuneate and sometimes rounded or subcordate. The line of insertion is slightly arched and there is sometimes a rudimentary radicelliferous disc at the base. Except on the caudex, however, rhizoids are very scantily developed.

In the majority of cases the inflorescence is dioicous, but a few autoicous species have been described. The female inflorescence is borne on a secondary stem or one of its leading branches and usually innovates on only one side. In a few species, however, two subfloral innovations are occasionally developed. An innovation spreads obliquely and frequently forms a second archeogonium after bearing only one or two pairs of foliage leaves. When this procedure is repeated several times in succession, a cymose flower-cluster is the result, in which the flowers seem to be borne along the upper side of a floral axis. In rare cases an innovation is terminated by an antheridial spike. The bracts are unequally bifid and sharply complicate but are apparently never winged along the keel. The lobes spread obliquely and are relatively narrower than in the leaves, often showing a tendency to be sharp-pointed at the apex. The lobule is also narrow and varies at the apex from rounded to acute. The bracteole is free and ovate to obovate in outline, the apex showing all variations in different species from rounded or retuse to bidentate or bifid. In both bracts and bracteoles the margins are commonly entire. The perianth is oblong to obovate in outline, with a rounded or truncate apex and a short beak. It is more or less compressed with sharp lateral keels (FIGURE 8). The antical surface commonly bears a short and low keel in the upper part, while the postical surface bears two sharp and confluent keels extending to below the middle. Both lateral and postical keels usually develop narrow and interrupted wings which are either irregularly sinuous or angular-dentate along the margin. In other respects the surface of the perianth is smooth.

The male inflorescence is large and conspicuous, terminating a secondary stem or one of its leading branches; in many cases, however, it proliferates at the apex. The diandrous bracts are loosely imbricated and unequally bifid, both lobe and lobule being either

rounded or very obtuse at the apex. The bracteoles extend the whole length of the spike and are much like the underleaves.

Several genera of the *Lejeuneae Holostipae* are more or less closely allied to *Archilejeunea*. Certain species of *Brachiolejeunea* and *Ptychocoleus*, for example, develop a five-keeled perianth which is built up on a very similar plan. In *Brachiolejeunea*, however, the lobule is differently constructed and shows a larger number of marginal teeth, while in *Ptychocoleus* no subfloral innovations are present. Both of these genera, moreover, are composed of prostrate species which show no distinction between caudex and secondary stems, and which are further characterized by the smooth and wingless keels of their perianths. In *Mastigolejeunea* the distinction between caudex and secondary stems is well marked but the perianth is sharply trigonous with smooth keels. Spruce divided his subgenus *Archi-Lejeunea* into two sections: *Monotropella*, in which the keels of the perianth are rough and the subfloral innovations usually occur singly; and *Dibrachiella*, in which the keels are smooth and the innovations are sometimes borne in pairs. Schiffner accepts both of these sections, making them subgenera of his genus *Archilejeunea*. Whether the slight differences just noted will ever be deemed sufficient to separate the groups generically is doubtful, since they share so many characters in common. It must be admitted, however, that *Dibrachiella* shows an especially close relationship to *Brachiolejeunea* and *Ptychocoleus*.

In its restricted sense *Archilejeunea* is almost exclusively tropical in its distribution. A number of species have been described from Africa and from the islands of the Pacific, but the highest development of the genus is attained in South America, where about half of the known representatives have been collected. At the present time no species are definitely known from Asia and only two species, both belonging to the subgenus *Dibrachiella*, have been reported from the West Indies. One of these is *A. Auberiana* (Mont.) Steph., originally described from Cuba, and the other is *A. Cruegeri* (Lindenb.) Schiffn., originally described from Trinidad. The distribution of these two species beyond the islands where they were first discovered is still imperfectly known. Stephani, to be sure, has reported *A. Auberiana* from Paramaribo

and Para, * and Spruce has also reported *A. Cruegeri* from the latter locality.† Stephani's report is based on two specimens in the Lindenberg herbarium, one doubtfully referred to *Lejeunea unci-loba* Lindenb. and the other representing a portion of the original material of *L. cyclostipa* Tayl. The writer has examined both of these specimens and would refer the first to *L. (Archi-Lejeunea) florentissima* Spruce rather than to *A. Auberiana*; ‡ the second is unfortunately so fragmentary that positive determination is hardly possible. With regard to *A. Cruegeri* the type material itself is scanty and poorly developed, making it difficult to obtain an adequate idea of the species. In view of these facts confirmatory evidence as to the occurrence of *A. Auberiana* and *A. Cruegeri* in South America is much to be desired. Although *Archilejeunea* has not yet been reported from Puerto Rico, a single species, also belonging to the subgenus *Dibrachiella*, has been found on the island, namely:

***Archilejeunea viridissima* (Lindenb.)**

Lejeunea viridissima Lindenb. in G. L. & N. Syn. Hep. 320. 1845.

Lejeunea (Archi-Lejeunea) viridissima Steph. Hedwigia 29: 17. 1890.

Yellowish- or brownish-green, becoming darker with age, neither glossy nor glaucous, growing in depressed mats: caudex and secondary stems about 0.14 mm. in diameter, the latter simple or sparingly subdivided, often with poorly developed lobules: leaves imbricated, the lobe widely spreading, slightly falcate, broadly ovate, 0.75 mm. long, 0.6 mm. wide, convex, and sometimes revolute at the broad and rounded apex and along the postal margin, antical margin straight or a little rounded at the base, then strongly outwardly curved to the apex; lobule (when well developed) ovate, 0.35 mm. long, 0.25 mm. wide, the water-sac broad at the base and abruptly narrowed in the outer part, free margin sometimes revolute at the base, sometimes appressed to the lobe from base to apex, rounded, normally bearing two teeth in the outer part, the outer or apical a little longer than the other and often variously curved, the inner varying from acute to obtuse and sometimes

* Hedwigia 29: 15, 21. 1890.

† Hep. Amaz. et And. 97. 1884.

‡ See Torreya 7: 228. 1908.

absent altogether, papilla marginal at base of apical tooth, sinus shallow, keel slightly arched, forming a very obtuse angle with the postical margin of the lobe; cells of lobe plane or a little convex, averaging 12μ at the margin, $24 \times 18\mu$ in the middle and $28 \times 18\mu$ at the base, trigones large, triradiate with rounded ends, separated from the oblong to circular intermediate thickenings by narrow pits: underleaves distant to loosely imbricated, appressed on the caudex but more or less squarrose on the secondary stems and sometimes revolute at the apex and along the sides, broadly orbicular-obovate, averaging 0.35 mm. in length and 0.4 mm. in width, cuneate at the base, rounded to subretuse at the apex: inflorescence polyoicous: ♀ inflorescence terminating a secondary stem or one of its leading branches, innovating on one side or rarely on both, the innovations short and sterile or soon again floriferous, rarely terminating in an antheridial spike; bracts erect-spreading, deeply and unequally bifid, complicate, the lobe oblong-obovate, 0.95 mm. long, 0.5 mm. wide, more or less convex and often revolute along the postical margin and at the apex, lobule ovate to ligulate, 0.4 mm. long, 0.15 mm. wide, rounded to subacute at the apex, keel very short; bracteole obovate, averaging 0.75×0.4 mm., rounded to retuse at the apex; perianth about half exserted, oblong-obovate in outline, cuneate toward the base, 1.4 mm. long, 0.75 mm. wide, antical keel low and broad, lateral and postical keels high and sharp, usually bearing narrow wings from one to three cells wide and variously sinuate or subcrenulate on the margin: ♂ inflorescence terminating a short branch, apparently not proliferating; bracts loosely imbricated, mostly in from three to six pairs, unequally bifid, the lobe oblong to rounded at the apex, lobule similar but shorter and narrower, keel strongly arched; antheridia in pairs; bracteoles similar to the underleaves but smaller: capsule about 0.4 mm. in diameter, yellowish-brown; spores greenish, irregular in form, about 16μ in short diameter, minutely verruculose; elaters 9μ in diameter. (PLATE 8, FIGURES 1-8.)

On a log. El Yunque, *Evans* (140). Type locality: Caracas, Venezuela (herb. Hampe). The species has also been found on the island of Great Bahama, *Britton & Millspaugh*. The type material preserved in the Lindenberg herbarium agrees closely with the Puerto Rico and Bahamian specimens.

Archilejeunea viridissima is closely related to *A. Auberiana*. Through the kindness of M. Paul Hariot the writer has been supplied with a portion of the original material of the latter species from the Montagne herbarium. It shows an autoicous inflorescence and agrees with *A. viridissima* in size, habit, and color.

The lobules in both species are normally bidentate, and the perianths are five-carinate with smooth or nearly smooth keels. The lobule in *A. Auberiana*, however, is subrectangular in outline rather than ovate, the keel being nearly straight, and the marginal teeth tend to be larger and more pronounced than in *A. viridissima*. The leaf-cells also offer certain points of distinction, although they average about the same in size. In *A. Auberiana* the local thickenings of the walls are rarely confluent, the trigones are mostly in the form of equilateral triangles with straight sides, and the intermediate thickenings are oval or circular in outline. In *A. viridissima*, on the other hand, the thickenings are more frequently confluent, the trigones show a strong tendency to be triradiate, with rounded and often constricted rays, and the intermediate thickenings show a similar tendency to be rectangular, with rounded ends. *A. Auberiana* is further characterized by the lobules of its perichaetial bracts; these are much smaller than in *A. viridissima* and are usually adnate to the lobes throughout their entire length. Although the differences which have just been enumerated are slight, they seem to be constant.

Another allied species is *Lejeunea florentissima* Spruce, which the writer would keep distinct from *A. Auberiana*. This species is more robust than *A. viridissima*, and the lobes of the leaves are more falcate; the keel of the lobule is parallel with the free margin, but both are more or less curved; the trigones in the leaf-cells are similar to those in *A. Auberiana* but are better developed, the sides of the triangles being convex rather than straight. The subfloral innovations in *L. florentissima* are usually soon floriferous and the perianths are thus crowded together in a cymose cluster; in *A. viridissima* the arrangement of the perianths is much more irregular.

LEUCOLEJEUNEA

The characters of the genus *Leucolejeunea*, recently segregated by the writer from *Archilejeunea*, have already been so fully discussed* that it hardly seems necessary to enumerate them here. Five species are definitely known at the present time, the generic type being *L. clypeata* (Schwein.) Evans, a widely distributed species in the eastern United States. The only representative of

* See Torrey 7: 225-229. 1908.

the genus which has been found in Puerto Rico is *L. xanthocarpa*, although *L. unciloba* (Lindenb.) Evans is surely to be expected on the island.

LEUCOLEJEUNEA XANTHOCARPA (Lehm. & Lindenb.) Evans

Jungermannia xanthocarpa Lehm. & Lindenb. in Lehmann, Pug. Plant. 5: 8. 1832.

Lejeunea xanthocarpa Lehm. & Lindenb.; G. L. & N. Syn. Hep. 330. 1845.

Lejeunea (*Archi-Lejeunea*) *xanthocarpa* Pears. Christiana Vidensk.-Selsk. Forh. 1887⁹: 4. pl. 1. f. 14-24.

Archilejeunea xanthocarpa Schiffn. Conspect. Hepat. Archip. Indici 316. 1898.

Leucolejeunea xanthocarpa Evans, Torreyia 7: 229. 1908.

Pale glaucous-green, varying to bright-green and becoming yellowish or brownish upon drying, growing in depressed mats: stems 0.15 mm. in diameter, the branches obliquely to widely spreading, with smaller leaves than the stem but not microphyllous, sterile branches mostly simple or sparingly subdivided: leaves imbricated and usually densely so, the lobe (when flattened out) orbicular-ovate, 1 mm. long, 0.85 mm. wide, convex and strongly revolute at the broad and rounded apex and along the whole postical margin, antical margin straight or slightly rounded at base, then outwardly curved to the apex; lobule narrowly ovoid, 0.4 mm. long, 0.2 mm. wide, gradually contracted in the outer half, the water-sac opening directly into the revolute portion of the lobe, keel straight or slightly arched continuous with revolute portion or slightly indented at junction, apex (not visible without flattening or dissection) varying from bluntly pointed to acuminate, in the latter case tipped with a row of from two to four cells, sinus straight or slightly lunulate, hyaline papilla mostly three to six cells from the apex; cells of lobe plane or slightly convex, averaging 14μ at the margin, 20μ in the middle, and $28 \times 20\mu$ at the base: underleaves imbricated, plane (or a little convex from below), reniform, 0.5 mm. long, 0.7 mm. wide, rounded to cordate at the base, rounded to vaguely retuse at the apex: ♀ inflorescence borne on a more or less abbreviated branch, sometimes with only one pair of leaves below the involucre, innovating on one side; bracts erect-spreading, the lobe falcate, convex, revolute at the rounded apex and along the postical margin, oblong-obovate, 1 mm. long, 0.6 mm. wide, lobule oblong, 0.4 mm. long, 0.2 mm. wide, rounded to subacute at the apex, keel sometimes narrowly winged; bracteole broadly obovate, 0.95 mm. long, 0.75 mm. wide, slightly

retuse at the apex; perianth almost hidden by the involucre, 1 mm. long, 0.7 mm. wide, narrowed toward the base, rounded to slightly retuse at the apex, beak 0.1–0.15 mm. long, keel roughened by projecting cells but destitute of wings or distinct teeth: ♂ inflorescence as described under the genus. (PLATE 7, FIGURES 12–23.)

On trees. Near Cayey, *Evans* (76). The species is also known from the following islands of the West Indies: New Providence, Bahamas, *A. E. Wight*, *E. G. Britton*; Jamaica, *Underwood*, *Evans*; Guadeloupe, *Husnot*, *Duss*; Dominica, *Elliott*; Martinique, *Duss*. On the American continent its range extends from Mexico to Brazil (the type locality). There are also records from Java and from Fernando Po, Mount Kilimanjaro and Cape Colony in Africa. A fragment of the type specimen in the Lindenberg herbarium, collected by Beyrich in 1823 at New Freiburg, Brazil, agrees closely with the specimens here described.

Apparently the closest allies of *L. xanthocarpa* are *L. uniloba*, which has already been mentioned, and *L. conchifolia* *Evans*.* Both of these species have convex lobes and long teeth at the apices of the lobules. In *L. uniloba*, however, the apex of the lobe is only slightly revolute, and the apical tooth of the lobule is easily visible without dissection. In *L. conchifolia* the plants are less robust than in *L. xanthocarpa*, the lobes of the leaves spread more obliquely, the lobules are relatively larger, and their apical teeth are more like those of *L. uniloba*, being readily demonstrated without dissection. *L. xanthocarpa* also bears a strong superficial resemblance to *Pycnolejeunea Schwaneckeii* (Steph.) Schiffn., which is of course at once distinguished by its bifid underleaves.

ANOPOLEJEUNEA

The genus *Anopolejeunea*, as defined by Schiffner, contains the single species *A. herpestica* (Spruce) Schiffn. Apparently nothing has been written about this species except the rather brief descriptions of Spruce and Schiffner. The writer finds, however, upon examining a portion of the type material of *A. herpestica*, kindly

*For descriptions and figures of these two species see *Evans*, Mem. Torrey Club 8: 125–129. pl. 16. f. 12–20; pl. 17. f. 1–9. 1902. *L. uniloba* is there called *Archilejeunea Sellowiana* Steph., a species which the writer now considers synonymous with the much older *Lejeunea uniloba* Lindenb. See also *Torreya* 7: 229. 1908.

sent by Mr. M. B. Slater, that it is quite indistinguishable from the widely distributed *Lejeunea conferta* Meissn. Although placed by recent writers in *Archilejeunea*, *L. conferta* cannot be considered congeneric with the typical members of this genus, and there seem to be excellent reasons for maintaining *Anoplolejeunea* as distinct. Spruce compares it with his subgenus *Platy-Lejeunea*, but it is evidently much more closely related to the genus *Leucolejeunea*.

The plants grow in depressed mats and are either pale- or dark-green in color with neither glossiness nor pigmentation. The prostrate stem is copiously and irregularly branched, some of the branches being similar to the stem while others are ascending and distinctly microphyllous (PLATE 8, FIGURE 9). The normal leaves are imbricated, the convex lobe spreading widely and showing a rounded apex and entire margin. The leaf-cells are plane or nearly so, with small trigones and occasional intermediate thickenings (FIGURE 16), and ocelli are sometimes present at the base of the lobe (FIGURE 17).

The lobule when normally developed is more complicated than in most of the other genera of the *Lejeuneae*. It is ovate-oblong in outline and forms a strongly inflated water-sac with an arched and convex keel (FIGURE 9). From a relatively short base it is abruptly dilated and becomes suddenly contracted in the outer part. The dilated portion, bounded by the rounded and entire free margin, forms a volute with about one and a half turns (FIGURE 14). This comes into contact with the lobe, thus enclosing the water-sac, but the margin itself, together with a considerable extent of the lobule, lies free within the sac and can be distinguished by careful focusing from below. The lobule develops no apical tooth, the free margin being directly continuous with the sinus; just at the junction of the two, however, a cell may be observed which is a little larger than its neighbors and which doubtless represents the terminal cell of the lobule, homologous with the 'apical tooth' of other *Lejeuneae* (FIGURE 18). At the beginning of its course the sinus is also strongly revolute but straightens out abruptly and passes into the postical margin of the lobe at the end of the keel. The hyaline papilla is marginal and arises from the terminal cell, usually at its junction with the first cell of the sinus; it may therefore be regarded as distal in posi-

tion. Unfortunately, the lobule is often poorly developed and fails to show some of the peculiarities which have just been described.

The underleaves are distant and smaller than is usual among the *Holostipae*. They are obovate and entire, the apex varying from truncate to slightly retuse. When rhizoids are developed they usually spring from a distinct basal radicelliferous disc.

The inflorescence is dioicous, and the male and female plants usually occur in separate mats. The female branch varies greatly in length and nearly always give rise to one or two subfloral innovations. In rare cases, however, the branch remains perfectly simple. The perichaetial bracts are a little larger than the leaves and their lobes are relatively narrower; the lobules are rounded to subacute and the sharp keels are narrowly winged. The bracteole is free and mostly obovate-oblong in outline, the apex varying from rounded to slightly retuse (FIGURES 19, 21). The perianth is obovoid and normally shows five sharp keels (FIGURE 23) and a short but distinct beak. The male inflorescence occupies a short branch or is terminal on a more or less elongated branch. The bracts are imbricated and diandrous, and the bracteoles are limited to the base of the spike.

Anoplolejeunea conferta (Meissn.)

Jungermannia conferta Meissn.; Sprengel in Linnaeus, Syst. Veg. ed. 16. 4: 325. 1827.

Lejeunea subaurita Nees & Mont. Ann. Sci. Nat. Bot. II. 5: 60. 1836.

Lejeunea Miquelii Lehm. & Lindenb. in Lehmann, Pug. Plant. 7: 15. 1838.

Lejeunea proteoides Lehm. & Lindenb, l. c. 7: 19. 1838.

Lejeunea conferta Meissn.; G. L. & N. Syn. Hep. 333. 1845.

Lejeunea involutiloba Mont. Ann. Sci. Nat. Bot. IV. 5: 350. 1856.

Lejeunea (*Anoplo-Lejeunea*) *herpestica* Spruce, Hep. Amaz. et And. 129. 1884.

Lejeunea (*Platylejeunea*) *conferta* Steph. Hedwigia 27: 284. 1888.

Lejeunea (*Archi-Lejeunea*) *conferta* Steph. l. c. 29: 21. 1890.

Anoplolejeunea herpestica Schiffn. in Engler & Prantl, Nat. Pflanzenfam. 1³: 131. 1895.

Archilejeunea conferta Schiffn. Conspect. Hepat. Archip. Indici
315. 1898.

Plants becoming yellowish or brownish upon drying: stems 0.17 mm. in diameter, branches obliquely to widely spreading: leaves imbricated, the lobe widely spreading, often revolute at the apex, falcate, broadly ovate, 1 mm. long, 0.85 mm. wide when of maximum size, often considerably smaller, arching across or a little beyond the axis, antical margin straight or slightly incurved near the base, then strongly outwardly curved to the apex, postical margin straight or somewhat curved, not revolute, forming an angle of 90 degrees or more with the strongly arched keel; lobule 0.35 mm. long, 0.2 mm. wide; cells of lobe averaging 17μ at the margin, 25μ in the middle and $40 \times 25\mu$ at the base, trigones triangular with concave sides, intermediate thickenings sometimes confluent with the trigones; ocelli (when present) mostly one to three, situated near the base of the lobe, measuring about $45 \times 32\mu$: underleaves broadly orbicular-obovate, 0.35 mm. long, 0.35–0.4 mm. wide, plane, cuneate and short-decurrent at the base: perichaetial bracts erect-spreading, the lobe obovate from a narrow base, 1.2 mm. long, 0.7 mm. wide, convex and revolute at the apex, rounded to obtuse at the apex, lobule ovate-oblong, 0.75 mm. long, 0.25 mm. wide; bracteole 0.4–0.75 mm. long, 0.25–0.4 mm. wide; perianth about two-fifths exerted at maturity, 1–1.3 mm. long, 0.7–0.75 mm. in diameter, apex variable, usually truncate or subretuse but sometimes rounded or even subacute, keels variable, sometimes low and almost obsolete, sometimes distinctly dilated in the upper part, when well developed showing a marginal row of slightly projecting cells with strongly thickened walls, postical surface of perianth sometimes developing one or two low and supplementary keels or folds: ♂ inflorescence apparently never proliferating; bracts mostly in from two to seven pairs, closely imbricated, inflated, shortly bifid, the lobe strongly convex, rounded at the apex, antical margin straight or a little incurved, keel strongly arched, lobule obtuse to acute at the apex; bracteoles similar to the underleaves but smaller: mature sporophyte not seen. (PLATE 8, FIGURES 9–23.)

On trees. Puerto Rico, without definite locality, *Sintenis* (100). The writer has seen no specimens of *A. conferta* from Puerto Rico but has collected it abundantly on the island of Jamaica, where it occurs at elevations of from 1,000 to 2,000 m. The species was originally collected in Peru but is now also known from Brazil, Bolivia, Venezuela, Trinidad, Colombia, and Mexico. Whether it occurs outside of tropical America is somewhat doubt-

ful. The Synopsis Hepaticarum cites it from the islands of Luzon and Java, and Schiffner also quotes the latter locality. Both of these records, however, are based on old collections.

The microphyllous branches of *A. conferta* (FIGURE 9) are very characteristic, although they are sometimes scantily developed and may even be absent altogether. The lobes of their leaves are orbicular-ovate in outline and average about 0.35 mm. in length; they are suberect or spread obliquely from the axis instead of spreading widely as on normal stems and branches. The lobules are nearly spherical and measure only 0.15 mm. in diameter, in other respects agreeing with those on typical leaves. The underleaves, except for their small size, present no distinctive peculiarities. Under certain circumstances the lobules are poorly developed even on the stems and leading branches (FIGURE 12) and thus give rise to forms which are not always easy to recognize. Usually a careful examination will reveal a few lobules of normal structure scattered among the others, and these will aid in the determination of such anomalous specimens. The characters upon which the varieties *Miquelii* and *Liebmaniana* of the Synopsis are based are apparently drawn from imperfectly formed lobules, and the propriety of attempting to maintain them is doubtful.

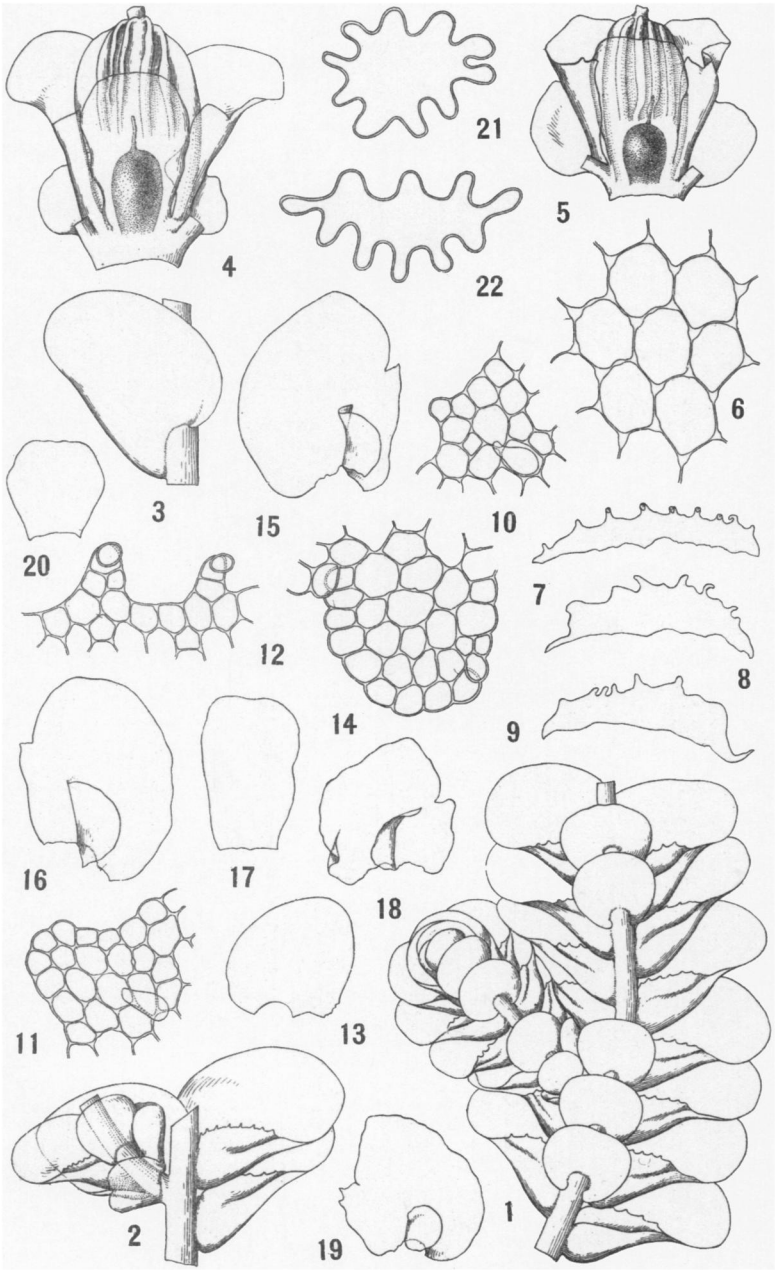
In the specimens from Jamaica the lobes of the leaves are usually distinctly ocellate at the base except on poorly developed individuals. In all the South American specimens, however, which the writer has been able to examine, the ocelli are apparently absent. If this difference should prove to be constant it might necessitate the separation of the West Indian plant as a distinct species. Unfortunately the South American specimens were all of old collections, and the detection of ocelli in plants of this character is sometimes very uncertain. Under the circumstances it seems best to include the Jamaican specimens with the others, a course which is advocated also by Stephani.

A. conferta bears a rather strong superficial resemblance to *Leucolejeunea clypeata*, the two species agreeing in color and in many of the characters derived from leaf-cells, underleaves, perichaetial bracts, and perianths. They differ strikingly, however, in the structure of the lobule, and *L. clypeata* is also distinct in its inflorescence, which is normally autoicous, and in its lack of micro-

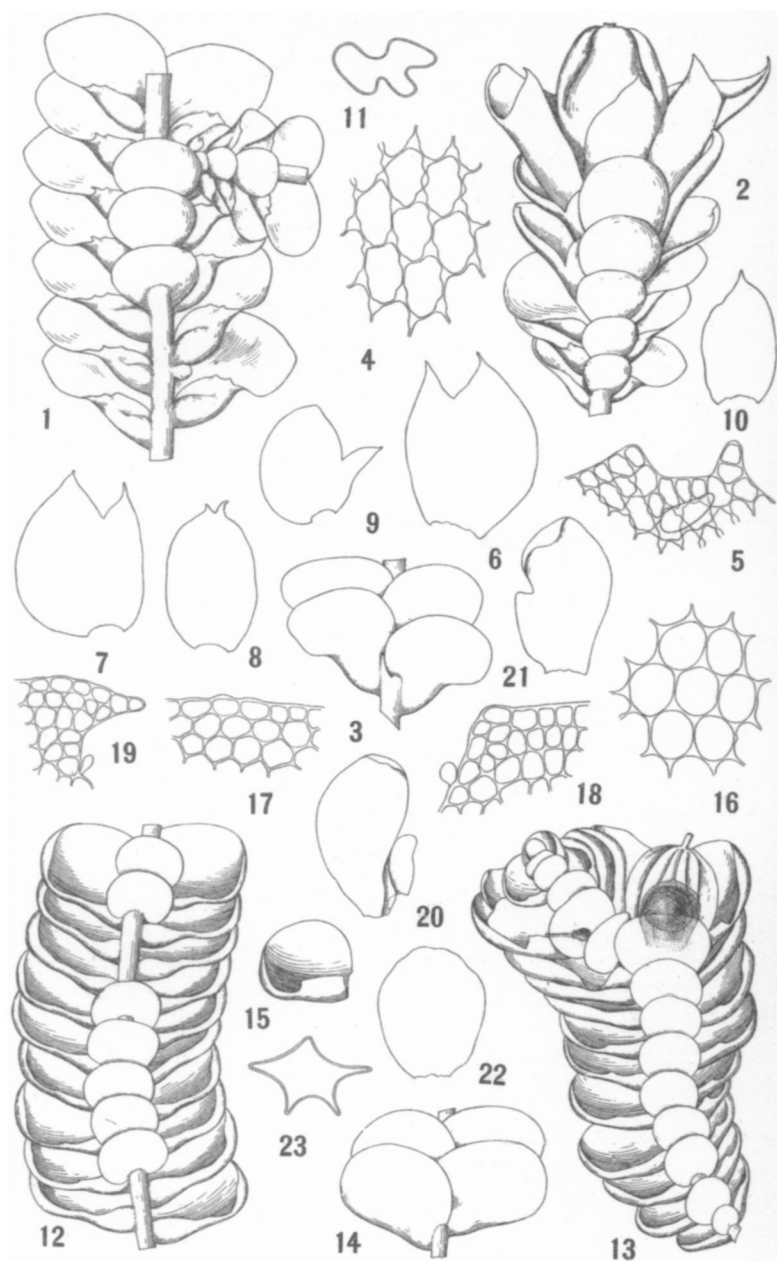
phyllous branches. There is little danger of confusing *A. conferta* with any other species of *Leucolejeunea*, in spite of the close relationship of the two genera.

The present paper concludes the discussion of the *Lejeuneae Holostipae* which are known to occur in Puerto Rico. Of the genera recognized by Schiffner the following four are apparently unrepresented on the island: *Ptychanthus*, *Thysananthus*, *Peltolejeunea* and *Dicranolejeunea*. The last of these genera is abundant on Jamaica at rather high altitudes and may therefore be expected to have a wider distribution in the West Indies. There is little probability, however, that any of the others will be found there, although each is represented in South America by one or more species. *Ptychanthus* and *Thysananthus*, in fact, are essentially paleotropic in their distribution and attain their highest development in the East Indies and the neighboring parts of Asia.

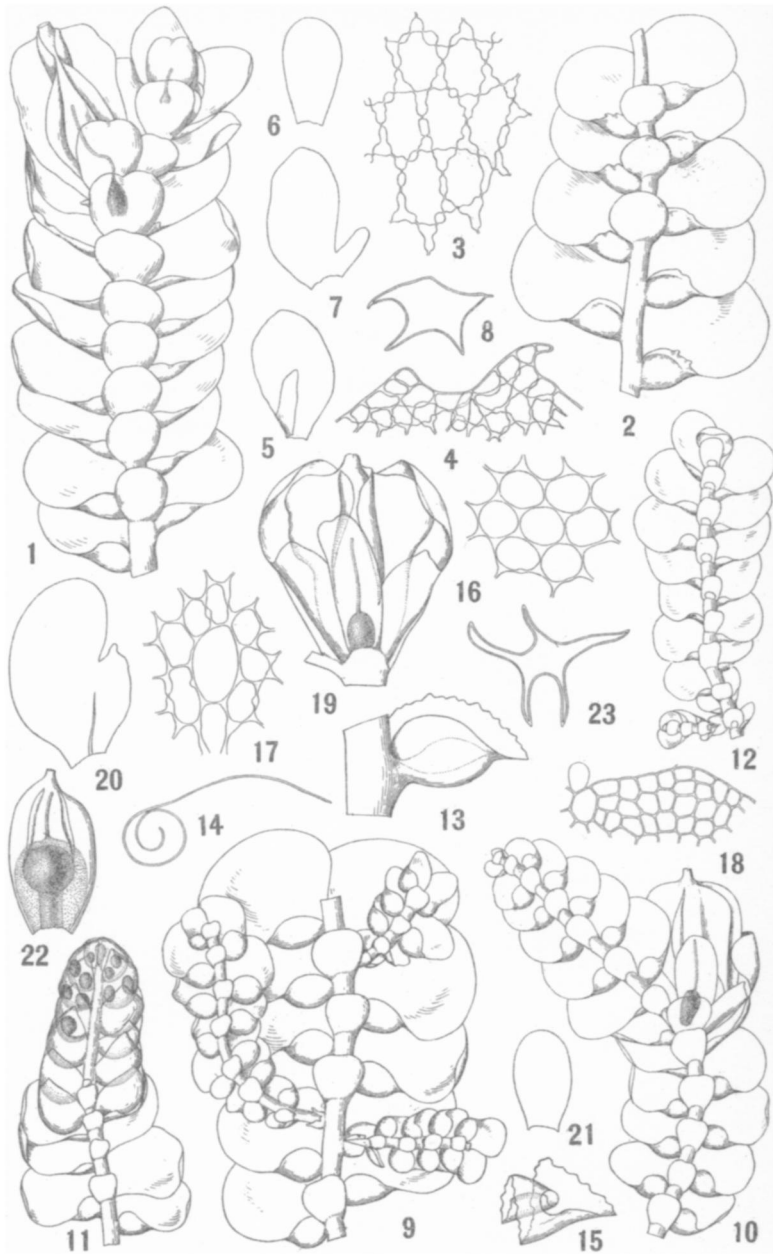
YALE UNIVERSITY.



BRACHIOLEJEUNEA INSULARIS Evans.



1-11 *PTYCHOCOLEUS POLYCARPUS* (Nees) Trevis.
 12-23 *LEUCOLEJEUNEA XANTHOCARPA* (Lehm. & Lindenb) Evans.



1-8 *ARCHILEJEUNEA VIRIDISSIMA* (Lindenb) Evans.
 9-23 *ANOPLOLEJEUNEA CONFERTA* (Meissn) Evans.

Explanation of plates 6-8

As in the previous papers of this series the figures were drawn by the writer and prepared for publication by Miss Hyatt.

PLATE 6

Brachiolejeunea insularis Evans. Part of stem with branch, postical view, $\times 15$. 2. Part of stem with base of branch, postical view, $\times 15$. 3. Leaf, antical view, $\times 15$. 4, 5. Perianths with involucre, the innovations dissected away, postical view, $\times 25$. 6. Cells from middle of lobe, $\times 265$. 7-9. Free margins of lobules, $\times 45$. 10, 11. Apices of lobules, $\times 200$. 12. Marginal teeth of lobule, $\times 200$. 13. Stem-leaf at base of branch, $\times 15$. 14. Basal auricle of underleaf, $\times 200$. 15-17. Bracts and bracteole from one involucre, $\times 15$. 18-20. Bracts and bracteole from another involucre, $\times 15$. 21, 22. Transverse sections of perianths, $\times 35$. Fig. 5 was drawn from specimen collected by Heller (4463a); Figs. 8, 9, 11, 18-20, from specimens collected by Howe (465); the remaining figures from the type specimen.

PLATE 7

Ptychocoleus polycarpus (Nees) Trevis. 1. Part of stem with base of a branch, postical view, $\times 15$. 2. Apex of female branch with perianth, postical view, $\times 15$. 3. Part of stem, antical view, $\times 15$. 4. Cells from middle of lobe, $\times 265$. 5. Margin of lobule, the apex on right, $\times 200$. 6-8. Bracts and bracteole from the same involucre, $\times 15$. 9. Subfloral leaf below involucre, $\times 15$. 10. Bracteole from another specimen, $\times 15$. 11. Transverse section of perianth, $\times 25$. The figures were all drawn from specimens collected by Howe (1411, 1414).

Leucolejeunea xanthocarpa (Lehm. & Lindenb.) Evans. 12. Part of sterile stem, postical view, $\times 15$. 13. Part of plant with perianth, postical view, $\times 25$. 14. Part of stem, antical view, $\times 15$. 15. Leaf with lobule flattened out, $\times 15$. 16. Cells from middle of lobe, $\times 265$. 17. Cells from antical margin of lobe, $\times 200$. 18, 19. Apices of lobules, $\times 200$. 20-22. Bracts and bracteole from the same involucre, $\times 25$. 23. Transverse section of perianth, $\times 35$. The figures were all drawn from specimens collected by the writer (76).

PLATE 8

Archilejeunea viridissima (Lindenb.) Evans. 1. Apex of female stem with perianth, postical view, $\times 25$. 2. Part of caudex, postical view, $\times 25$. 3. Cells from middle of lobe, $\times 265$. 4. Margin of lobule, the apex on right, $\times 200$. 5, 6. Bract and bracteole from the same involucre, $\times 25$. 7. Bract from another involucre, $\times 25$. 8. Transverse section of perianth, $\times 25$. The figures were all drawn from specimens collected by the writer (140).

Anoplolejeunea conferta (Meissn.) Evans. 9. Part of sterile stem with microphyllous branches, postical view, $\times 25$. 10. Female branch with perianth, postical view, $\times 25$. 11. Apex of male branch, postical view, $\times 25$. 12. Branch with poorly developed lobules, postical view, $\times 25$. 13. Lobule, postical view, $\times 45$. 14. Longitudinal section through lobe and lobule, $\times 45$. 15. Mouth of lobule, diagrammatic. 16. Cells from middle of lobe, $\times 265$. 17. Cells from base of lobe, enclosing an ocellus, $\times 200$. 18. Margin of lobule, apical end on left, $\times 200$. 19. Perianth with involucre, postical view, $\times 35$. 20, 21. Bract and bracteole from a single involucre, $\times 25$. 22. Perianth, postical view, $\times 25$. 23. Transverse section of perianth, $\times 35$. The figures were all drawn from Jamaican specimens collected by the writer (43, 272, 424).